ABSTRACT

Imminent, Distant or Unlikely: Generating New High-Resolution Climate Change Scenarios for the Caribbean using a Perturbed Physics Ensemble Approach

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In this study we evaluate the perturbed physics approach for use in generating future scenarios of climate change for the Caribbean region. Seventeen members of the Hadley Centre's Quantifying Uncertainty in Model Predictions (QUMP) project are evaluated and a subset of six members chosen to be downscaled over the Caribbean. The perturbed physics ensemble is shown to reasonably represents the large-scale climate patterns of the region but underestimate rainfall in the early Caribbean rainfall season. Justifications are provided for choosing the six-member subset based on (I) the spread of each member's performance with respect to Caribbean temperature and rainfall characteristics, and (II) the extent to which they reasonably capture the characteristics of the full ensemble. The six-member ensemble is then downscaled using the PRECIS (Providing Regional Climates for Impact Studies) regional climate model simulations over the Caribbean and Central Americas for the SRES A1B scenario and used to generate new mid-century and end-of-century projections for the Caribbean region. Results for six Caribbean sub-regions are also generated from the downscaled results. The region is shown to be on average 2.1°C (>4°C) warmer and 40% (70%) drier by mid-century (end-of-century) with significant sub-regional variation. Finally, the perturbed physics six-member ensemble is used to ascertain the region's climatic state when the globe is 1.5°C, 2.0°C and 2.5°C above pre-industrial (1860-1900) levels. The analysis shows that under the A1B scenario the three global warming targets will likely be attained before mid-century – in the mid-2020s for 1.5°C, end of the 2030s for 2.0°C and in the early 2050s for 2.5°C. The Caribbean progressively warms and dries (especially the southern Caribbean) for each higher global warming threshold with significant sub-regional variation. There are implications for urgent and targeted planning with the transition from 1.5°C to 2.0°C seeming to be a turning point for the Caribbean.

Keywords: Caribbean Climate; Climate Change; PPE; QUMP; Climate Modelling; SRES; JD Campbell, PRECIS.